Diode Laser (CA-1220)

Within the kit a 100 mW laser diode mounted on a TE-cooler is used. The spatial distribution of the laser beam is measured with the help of a 2D rotational mount. The versatile control electronics enables the students to evaluate the dependency of the laser wavelength on the laser chip temperature and on the laser injection current. An examination of the laser wavelength will be done by means of a Nd:YAG rod which has well known light absorption transitions. The polarization of the laser light and its dependency on the injection current will be analyzed by a polarizing filter mounted in a rotation unit. For standard applications a digital voltmeter is provided and can be connected to the internal amplifier of the laser diode controller to take measurements. The use of an oscilloscope for higher quality measurements with modulated laser light for environmental light compensation is recommended and can be offered by eLas optionally.

Educational Objectives of Investigation

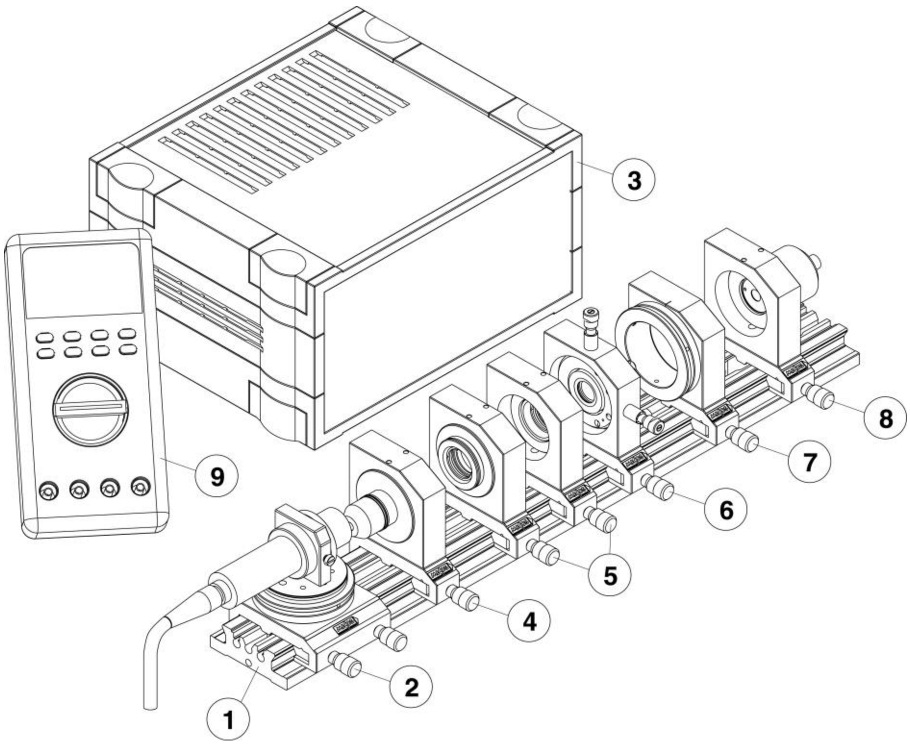
- Types of Laser Diodes
- Beam Profile
- Fast and Slow Axis
- Spectral Properties
- Laser Threshold
- Slope Efficiency
- Beam Shaping
- Polarization State

Ordering Information

For ordering the Diode Laser experimental kit (CA-1220)
use ordering number: 490091220

www.e-las.com contact@e-las.com Phone +49 761 2172 4873

Setup and Components



1 Flat rail 500 mm with scale

2 Laser light source 100 mW @ 808 nm, stabilized temperature, in rotating holder on carrier platform

3 Laser diode controller LDS 1200

4 Laser light collimator unit in holder on carrier

5 Pair of laser beam shape optics in holder on carrier

6 Nd:YAG crystal in XY adjustment holder on carrier

7 Polarization filter in holder on carrier

8 PIN-photo detector in holder on carrier

9 Digital voltmeter (3 ½ digits)

10 Set of interconnection cables (not shown)

11 User manual (not shown)

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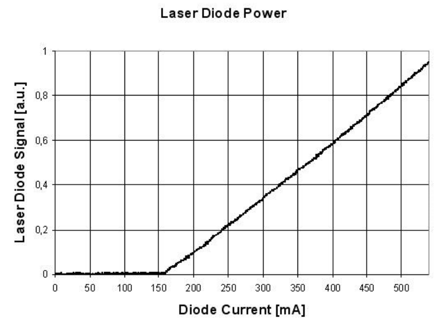
Measurements and Handling

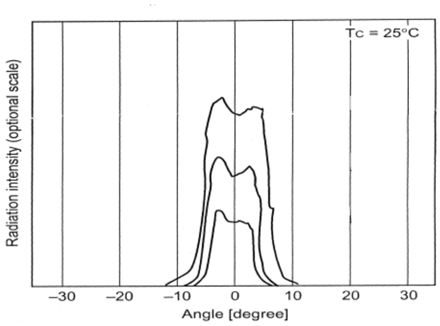
Some of the possible measurements are presented in the following list:

- **Laser diode output power versus current**



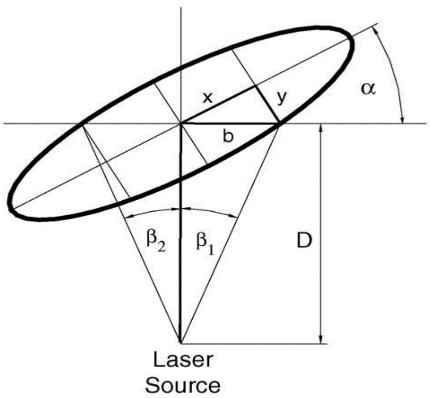
The relative output power of the laser diode can be measured in dependence on the injection current. The laser diode current is either stepwise increased at the settings of the controller, or can be periodically ramped up and down by the internal modulator of the controller. The relative laser power is measured by the photodiode detector, and parameters like laser threshold and slope efficiency are evaluated.

- **Power distribution of far field pattern**



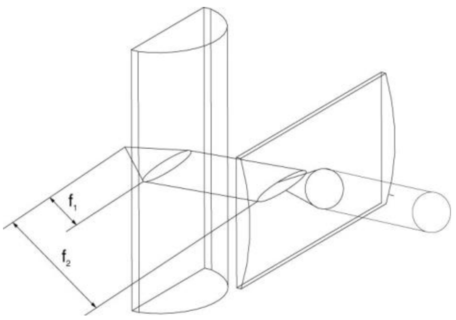
The profile of the power distribution of the laser diode beam in the far field is measured. The laser diode module is rotated around the swivel joint of its carrier. The laser intensity as a function of the rotation angle is measured with the photodiode detector. Due to the possibility of rotating the laser diode around the beam direction, both, the fast and the slow axis beam profile can be measured.

- **Beam shape measurement of the laser diode**



The goal is to measure the elliptical beam shape of the laser diode and to determine the perpendicular and parallel angle of radiation. Since the laser diode is mounted in a holder of two degrees of freedom of rotation, all necessary angles can be measured without moving the photodiode detector. From the measured angles the elliptical beam shape can be calculated and drawn.

- **Beam shaping of laser diodes**



The strongly elliptical beam shape of the laser is often a disadvantage of diode lasers compared to solid state or gas lasers with their almost round beam profile. To reduce the ellipticity to a minimum lenses for beam shaping are used. The education kit provides two cylindrical lenses for demonstration how this beam shaping is realized.

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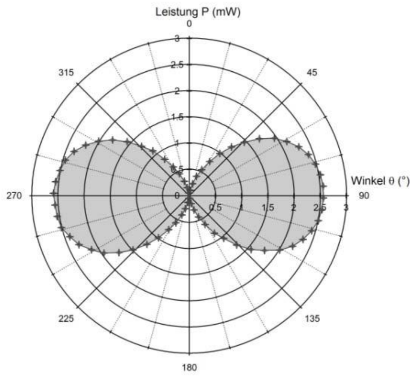
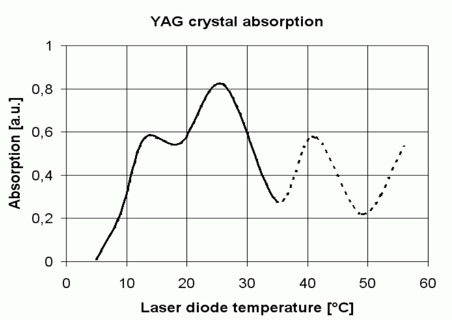
- **Polarization behaviour of laser diodes**



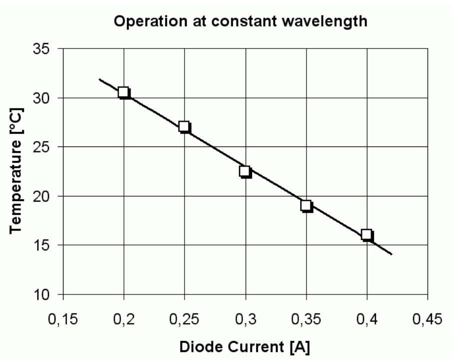
Using a rotatable analyzer and the photodiode detector the intensity distribution of the linear polarized laser diode light and its cos^2-dependence can be demonstrated.

- **Wavelength dependence of laser diodes**



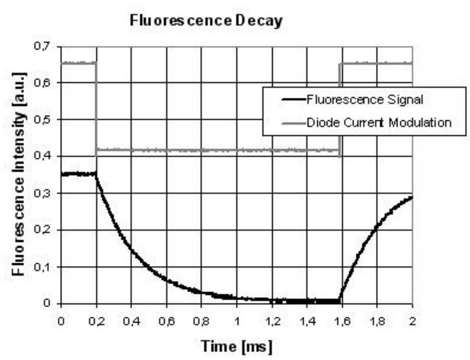
The absorption spectrum of the Nd:YAG crystal in dependence of the temperature of the laser diode is measured. Using the known absorption lines of Nd:YAG the transmitted intensity or the fluorescence intensity of the crystal is measured. By varying the laser diode temperature its emission wavelength is scanned. The correlation between laser diode temperature and wavelength shift is calculated.

- **Wavelength dependence on injection current**



Increasing of wavelength proportional to raising power is characteristic for laser diodes. To compensate this behavior it is necessary to vary its temperature. Operation at a constant wavelength is realized by working at an absorption minimum (i.e. maximum transmission) and optimization of the temperature and current for maximum transmission.

- **Measurement of life time of fluorescent light**



The $^4F_{3/2}$ level is the starting level for the emission at 1064 nm. The life time of the fluorescence of the Nd:YAG crystal pumped by the laser diode is detected. The current of the diode is TTL modulated and the decay curve of the fluorescence is measured.

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